

*Storage***Works**TM Solutions

Enterprise Storage Array for Bandwidth Intensive Applications

User's Guide

Order Number: EK-ESAD4-UG. A01

This manual describes the concepts and procedures necessary to use the Enterprise Storage Array. Mechanical cabinet configuration and power configuration are covered in this manual.

**Digital Equipment Corporation
Maynard Massachusetts**

September 1996

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Preface

This document presents the concepts and procedures necessary to install, configure, and use StorageWorks™ Enterprise Storage Array data center cabinets. Mechanical cabinet configuration and power configuration are covered in this manual. The configuration and connection of small computer system interface (SCSI) signal buses are covered in referenced StorageWorks documentation. Please refer to the accompanying StorageWorks documentation for removal and replacement procedures for all shelves and SBBs.

Intended Audience

This publication is for use by customers and Digital™ employees responsible for configuring, installing, and maintaining the StorageWorks subsystem and its components.

Structure

This manual contains the information and procedures to support the Enterprise Storage Array configuration. The design and connection of SCSI signal buses and replacement procedures are covered in referenced documentation. This manual is organized as follows:

- Chapter 1 presents an overview of the StorageWorks Enterprise Storage Array.
- Chapter 2 presents an overview of all SBB devices.
- Chapter 3 describes how to install the array controller SCSI cables and array controller software.
- Chapter 4 describes how to apply power to the ESA cabinet and also includes cable interconnect descriptions.
- Chapter 5 describes installing the StorageWorks Command Console (SWCC).
- Glossary
- Index

Documentation Conventions

This guide uses the following conventions:

| Convention | Description |
|----------------------|--|
| boldface type | Boldface type indicates the first instance of terms being defined in text, in the glossary, or both. |
| <i>italic type</i> | Italic type indicates emphasis and complete manual titles. In the glossary, italic type also is used to indicate cross-references. |

Related Documentation

The following table lists StorageWorks user documentation shipped with the Enterprise Storage Array.

Provided Documentation

| Document Title | Order Number |
|--|---------------------|
| <i>HSZ50 Array Controller, Operating Software V 5.0, Release Notes</i> | EK-HSZ50-RN |
| <i>CLI Reference Manual</i> | EK-HSCLI-RN |
| <i>Configuring Your StorageWorks Subsystem</i> | EK-HSZ50-GN |
| <i>Servicing Your StorageWorks Subsystem</i> | EK-HSZ50-SV |
| <i>StorageWorks Solutions Enterprise Storage Arrays Installation Guide</i> | EK-SWESA-IG |
| <i>StorageWorks Solutions SBB User's Guide</i> | EK-SBB35-UG |

The following table lists StorageWorks user documentation related to, but not shipped with the Enterprise Storage Array.

Other Documentation

| Document Title | Order Number |
|--|---------------------|
| <i>StorageWorks Solutions 24-Shelf Data Center Cabinet (SW800-Series) User's Guide</i> | EK-SW800-UG |
| <i>StorageWorks Solutions 7 Device, 16-Bit SBB Shelf (BA356-S) Series User's Guide</i> | EK-BA356-UG |
| <i>StorageWorks Solutions 8-Bit I/O Module (BA35X-MG) User's Guide</i> | EK-35XMG-UG |
| <i>StorageWorks Solutions Configuration Planning Guide</i> | EK-BA350-PG |
| <i>StorageWorks Solutions Product Catalog</i> | EK-BA350-PC |

Manufacturer's Declaration

This section describes environmental, physical, electrical, and safety specifications of the Enterprise Storage Array Subsystems.

Electromagnetic Compatibility

The Enterprise Storage Arrays Subsystems are CE-Mark Class A certified and you can install it in a commercial or office environment.

WARNING!

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Achtung!

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

AVERTISSEMENT!

Cet appareil est un appareil de Classe A. Dans un environnement résidentiel cet appareil peut provoquer des brouillages radioélectriques. Dans ce cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.

Safety

The Enterprise Storage Array Subsystems have been tested and are in compliance with the following safety standards.

Note

The equipment described in this manual is listed by the Underwriters Laboratories Incorporated (UL) and bears the UL Listing mark. These cabinets are also certified by the Canadian Standards Association (CSA) and TÜV Product Service GmbH and bear both the CSA certification and TÜV GS marks. This equipment also complies with the CE-Mark Class A requirements.

Note

Das in diesem Manual beschriebene Gerät wurde von TÜV Product Service GmbH auf Sicherheit geprüft und trägt das GS Zeichen. Bitte beachten Sie, daß Eingriffe in das Gerät, Reparaturen oder der Einbau von Erweiterungen nur von Digital Personal erfolgt dar, da sonst die GS Zulassung ungültig wird. Die Zulassung wird auch ungültig, wenn nicht von Digital aualifizierte Speichererweiterungen eingebaut werden. Das Gerät muß so aufgestellt werden, daß die Steckdose frie zugänglich iste.

Acoustic Noise Declarations

These cabinets and shelves have been tested in the indicated configurations. In the following tables 1 B (Bel) = 10 dBA.

Cabinet Acoustics — Preliminary Declared Values per ISO 9296 and ISO 7779

| Product | Sound Power Level L _{WAd, B} | | Sound Pressure Level L _{pAm, BA, (Bystander Positions)} | |
|---|--|---------|---|---------|
| | Idle | Operate | Idle | Operate |
| SW800-Cabinet with only cabinet fans operating | 6.4 | 6.4 | 55.7 | 55.7 |
| SW800-Cabinet with: Cabinet fans operating 3 — Controller shelves (BA350–M series) 18 — SBB Shelves (BA356–series) | 6.8 | 6.9 | 58.9 | 59.9 |
| 16-Bit SBB Shelf (BA356-JC series) with: 2 — Dual Speed Blowers (BA35X-MD) 2 — 150W ac input Power Supplies (BA35X-HF) | 5.6 | 5.6 | 37 | 37 |
| 16-Bit SBB Shelf (BA356-JC series) with: 2 — Dual Speed Blowers (BA35X-MD) 2 — 150W ac input Power Supplies (BA35X-HF) 6 — 4.3 GB 7200 RPM Disk Drives (RZ29B–VA) 1 — 8-bit I/O Module (BA35X–MG) | 5.8 | 5.9 | 40 | 41 |

| Gerät | Schalleistungspegel L _{WAd, B} | | Schalldruckpegel L _{pAm, dBA (Beistehende Position)} | |
|---|--|---------|--|---------|
| | Leerlauf | Betrieb | Leerlauf | Betrieb |
| SW800-Cabinet with only cabinet fans operating | 6.4 | 6.4 | 55.7 | 55.7 |
| SW800-Cabinet with: Cabinet fans operating 3 — Controller shelves (BA350–M series) 18 — SBB Shelves (BA356–series) containing | 6.8 | 6.9 | 58.9 | 59.9 |
| 16-Bit SBB Shelf (BA356-JC series) with: 2 — Dual Speed Blowers (BA35X-MD) 2 — 150W ac input Power Supplies (BA35X-HF) | 5,6 | 5,6 | 37 | 37 |
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Introducing the Enterprise Storage Array

This chapter presents an overview of the StorageWorks Enterprise Storage Array (ESA) for Bandwidth Intensive Applications cabinet.

1.1 Prerequisites

You will need a host SCSI adapter and a personal computer (refer to Chapter 5 for requirements) operating with the latest version of the StorageWorks Command Console (SWCC) to complete the ESA installation. Read the *HSZ50 Array Controller Operating System Release Notes* for a list of qualified adapters and to determine if any changes are required for the host operating system.

The SWCC cannot change a controller from *single* to *dual-redundant* configuration. If you need to change to a dual-redundant configuration, you must have a serial communication cable and a terminal or a PC running communication software. Refer to the *Configuring Your StorageWorks Subsystem* manual and the *CLI Reference* manual for detailed information about serial connection requirements and the required CLI commands.

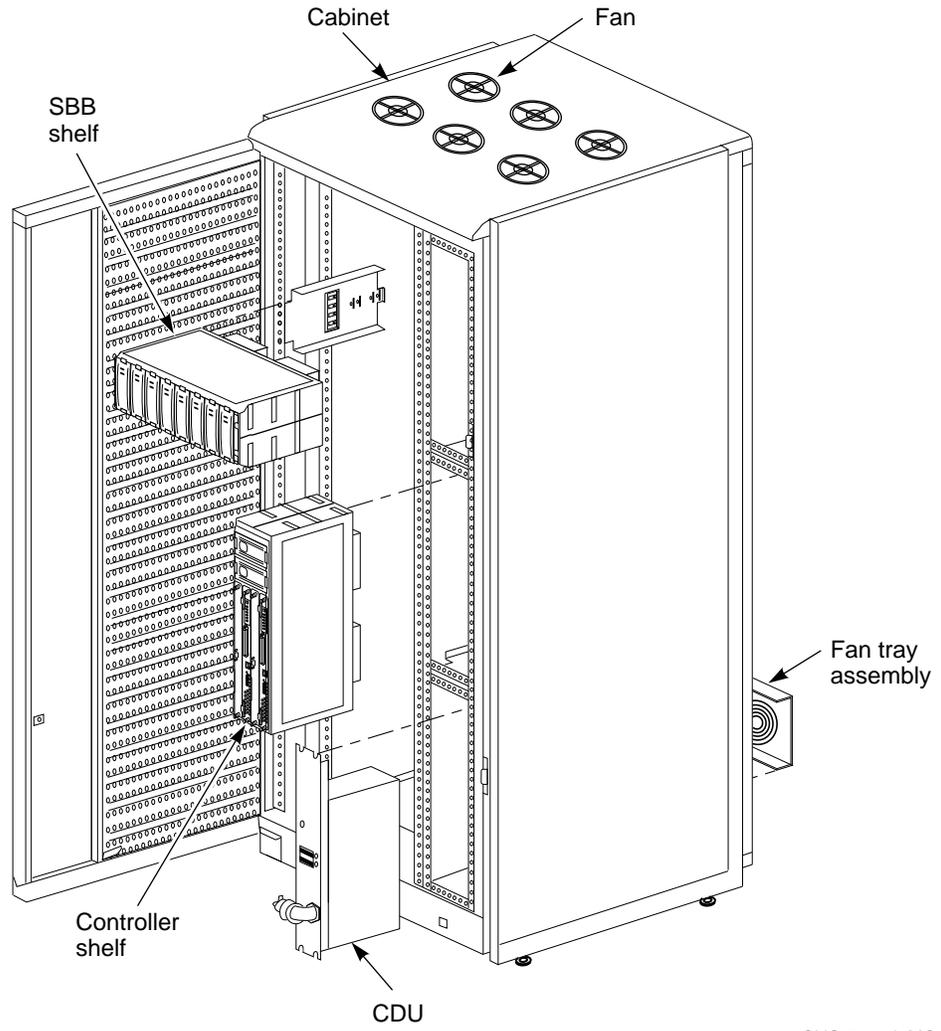
1.2 Major Components

The major components of the cabinet are shown in Figure 1-1 and are as follows:

- The cabinet has 19 horizontal and 4 vertical shelf positions. Controller shelves are installed in the middle and upper vertical shelf positions. The lower vertical shelf positions in the front and rear of the cabinet are each reserved for CDU installation and cable routing. Storage shelves are installed in the horizontal positions.
 - Power—The cabinet and its StorageWorks shelves are configured for redundant power. This configuration consists of two cable distribution units (CDUs) in the cabinet and two power supplies in each shelf. Each CDU requires a different power source. The primary shelf power supply connects to CDU A and the redundant shelf power supply connects to CDU B.
 - Cooling—The cabinet fans and the shelf blowers provide airflow through the shelves and the cabinet. Each StorageWorks shelf contains two rear-mounted blowers that move heat from the shelf into the cabinet interior. Six fans in the top of the cabinet draw air up through the center of the enclosure to blow the interior heat out through the top. Logic signals allow the status of the shelf blowers to be monitored by the host system.
- SBB shelves—StorageWorks building block (SBB) shelves house the SBBs in the StorageWorks family. The shelves have two power supply SBBs and a number of standard SBBs. SBB shelves have mechanical mounting, power, and signal interfaces for the SBBs they house.

- SBBs—StorageWorks building blocks are modular computer devices or power units from the StorageWorks family. SBBs may be disk drives, shelf power supplies, or external cache batteries (ECBs). They are housed in 3.5-inch wide modular carriers that plug into slots in the SBB shelves. Connectors on the rear of each SBB mate with connectors in the SBB shelf to provide the electrical interface between the two units.
- CDUs—Cable distribution units (CDUs) provide the connections necessary to distribute ac power to the shelves and fans within the cabinet. CDUs also provide surge and spike protection, along with a circuit breaker to control the incoming ac power. The two CDUs are configured with two separate ac power sources to provide redundant primary power within the cabinet. One CDU is installed in the lower vertical opening in each side of the cabinet.
- Array controller shelves—Array controller shelves are StorageWorks shelves designed specifically to house SCSI peripheral controller and cache memory modules. These shelves also have two power supply SBBs. Controller shelves provide the mechanical mounting, power, and signal interfaces for the units they house.
- Array controller—The array controller is the intelligent bridge between your host and the devices in your subsystem. The controller attaches to the host computer system using a fast, wide, differential (FWD) SCSI-2 bus. *Configuring Your StorageWorks Subsystem* contains a detailed description of the controller and its functionality.
- HSOF—The array controller operating software (HSOF) is the software component of the controller. It processes SCSI I/O requests from the host and performs the device-level operations required to satisfy the requests.
- Fan trays—The bottom rear-mounted fan tray occupies one shelf to provide improved cooling for 7200 rpm devices, such as the RZ29B-series disk drive. The three fans exhaust air out of the bottom rear of the cabinet.
- SWCC—The SWCC is graphical user interface (GUI) and network management program for StorageWorks controllers. It provides a method of monitoring, configuring, and troubleshooting your Enterprise Storage Array.

Figure 1-1 Cabinet Major Components



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Checking the SBBs

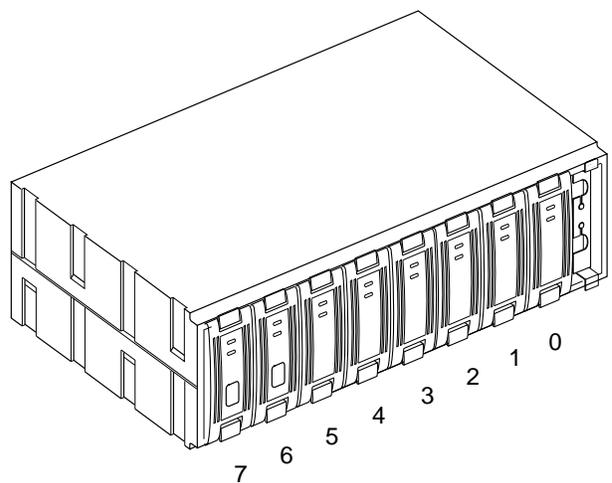
Prior to operation, you must inspect your StorageWorks Building Block (SBB) shelves to make sure all the cables and SBBs are securely mounted. Use this section to familiarize yourself with the operation of the SBB devices to prepare for applying power (refer to Chapter 4).

2.1 Shelf Description

A description of the SBB shelf and the components that comprise the SBB shelf are listed as follows: (refer to *StorageWorks Solutions 7 Device 16-Bit SBB Shelf BA356-S Series User's Guide* for more detailed information):

- The capacity of the shelf is eight 3.5-inch SBBs, (2 power supply SBBs and 6 device SBBs) and an I/O module.
- The SBB slots are numbered 0 through 7 from right to left starting with the slot adjacent to the I/O module (see Figure 2-1).

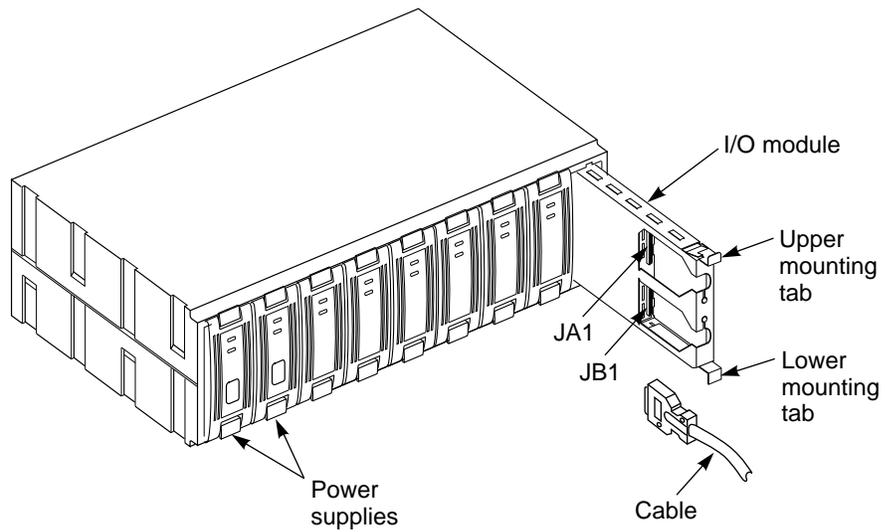
Figure 2-1 SBB Shelf



CXO-5411A-MC

- The I/O module provides a multifunction 8-bit extension of the 16-bit SCSI backplane. It functions as a platform onto which a wide range of logical and interactive circuitry can be connected (see Figure 2-2).

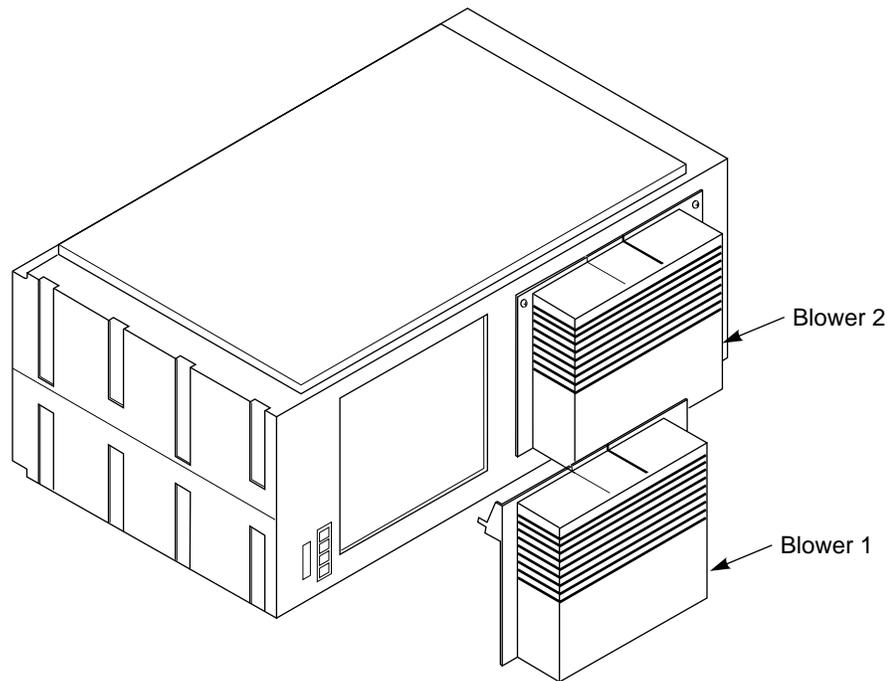
Figure 2-2 SBB Shelf with I/O Module



CXO-5375A-MC

- The I/O module provides the means of configuring device addressing in each shelf to permit a one- or two-shelf **daisy chain** array on one SCSI bus.
- There are six SCSI bus device addresses (that is, **target IDs**) that are numbered 0 through 5. These addresses are assigned to 3.5-inch SBBs based on the slots into which they are mounted.
- The single shelf SCSI device addresses and the slot numbers are the same for slots 0 through 5.
- Slot 6 is used for the redundant SBB power unit.
- Slot 7 is reserved for the shelf power unit and does not have a device address.
- There are two 50-pin, high-density, female SCSI connectors on the 8-bit I/O module that are used for I/O and daisy chaining shelves.
- As shown in Figure 2-3, each shelf has two blowers mounted on the rear of the shelf. These blowers pull air through the shelf and exhaust it out the rear.

Figure 2-3 Blower Assembly



CXO-5084A-MC

- The I/O module monitors the blower operation via the logic signals on the backplane:
 - When a high-ambient temperature condition is detected, both blowers automatically switch to high speed.
 - When one blower is defective, the other blower automatically switches to high speed to compensate.
 - The backplane supports the SCSI-2 and SCSI-3 bus.

2.2 Power Supply Fault Notification

As shown in Figure 2-4, each power supply SBB has two green LEDs that display the power supply status. Table 2-1 describes the state of these LEDs, the status being reported, and the recommended corrective action.

Figure 2-4 3.5-Inch Power Supply SBB

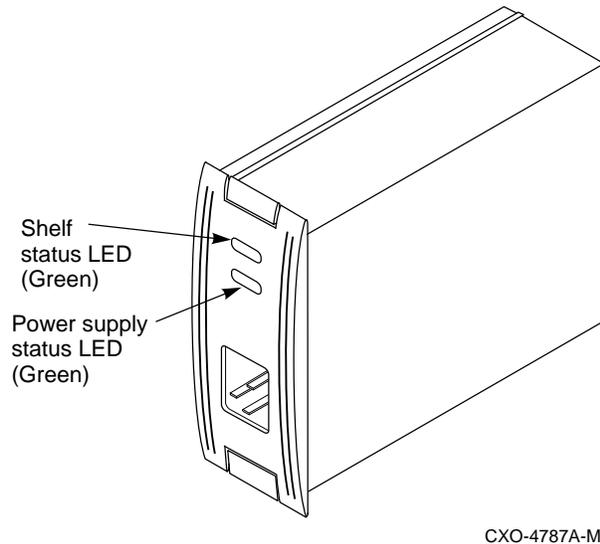


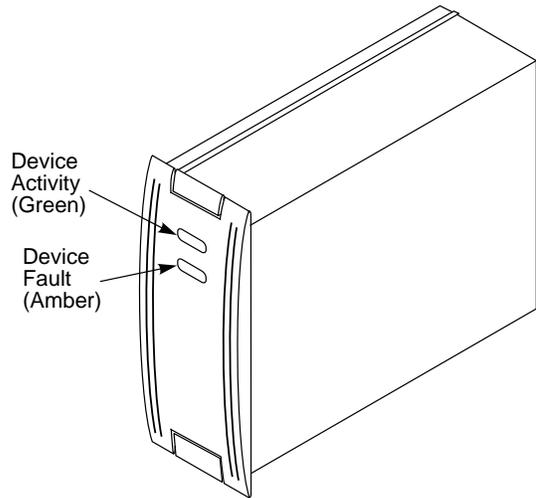
Table 2-1 Power Supply Status LED Displays

| When the LED display is... | The SBB power supply status is... |
|----------------------------|--|
| | <p>All the power supply SBBs on the <i>associated</i> power bus (either power bus A or power bus B) are functioning properly.</p> |
| | <p>At <i>least one</i> power supply SBB on the associated power bus has malfunctioned.</p> <p>This power supply SBB is functioning properly.</p> <p>Corrective Action:</p> <p>Identify and replace the defective power supply SBB.</p> |
| | <p>Either there is no ac power, the CDU has failed, or this power supply SBB has failed.</p> <p>Corrective Action:</p> <ol style="list-style-type: none"> 1. Check that ac power is applied. 2. Check the associated ac power entry controller for proper operation. Replace if necessary. 3. This power supply has failed and must be replaced. |

2.3 Storage Device Fault Notification

As shown in Figure 2-5, each 4.3 GB disk drive SBB has two LEDs that display the device status. Table 2-2 describes the state of these LEDs, the status being reported, and the recommended corrective action.

Figure 2-5 4.3 GB Disk Drive SBB



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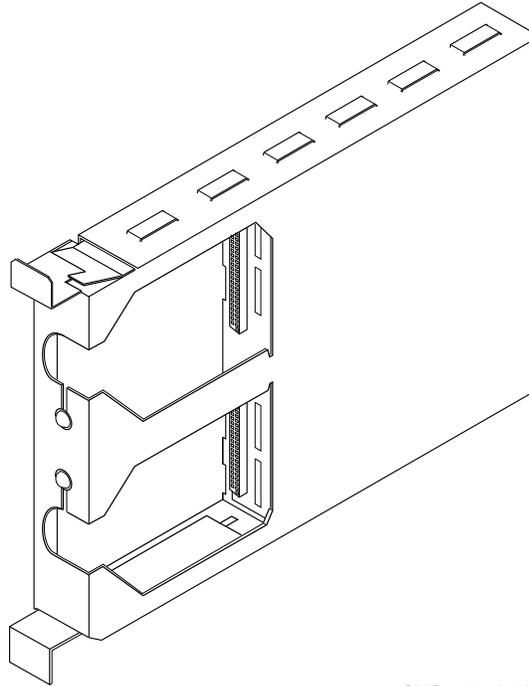
Table 2-2 Disk Drive SBB Status LED Displays

| When the LED display is... | The device SBB status is... |
|---|---|
|  | When the green Device Activity LED is ON or FLASHING, and the amber Device Fault LED is OFF, the SBB is operating normally. There is no fault. |
|  | When the green Device Activity LED is OFF and the amber Device Fault LED is OFF, the device is inactive and the SBB is operating normally. There is no fault. |
|  | Fault Status. When the green Device Activity LED is ON and the amber Device Fault LED is ON, the device is probably not responding to control signals. Corrective Action: 1. Quiesce the bus. 2. When the drive is spun down, replace the SBB. |
|  | Fault Status When the green Device Activity LED is ON and the amber Device Fault LED is FLASHING, the SBB is active and is spinning down. Recommended Corrective Action: 1. Quiesce the bus. 2. When the device is spun down (the green LED is OFF), replace the SBB. |

2.4 I/O Module

This section describes the 8-bit I/O module (see Figure 2-6). It explains how to install the I/O module in the SBB shelf, and how to set the shelf small computer system interface (SCSI) addresses.

Figure 2-6 8-Bit I/O Module



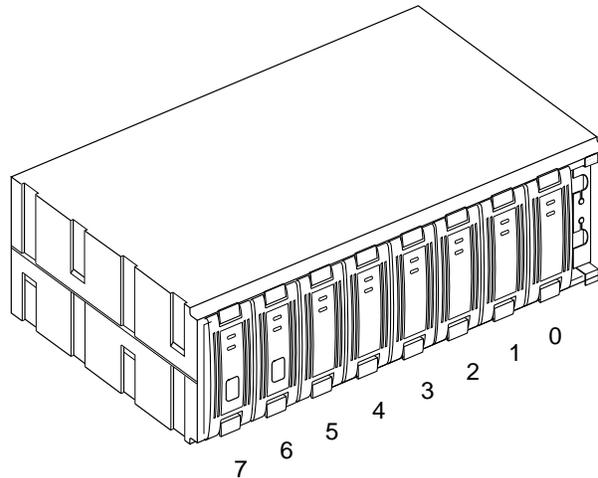
CXO-4821A-MC

The I/O module employs active circuitry to provide the following features to the SBB shelf:

- Eight-bit data bus connections to external units
- Shelf device address assignment
- Blower speed control
- Blower fault indicators
- Ambient air overtemperature sensing and indication
- Active, automatic bus termination

The 8-Bit I/O module is located on the right side of the SBB shelf to the right of slot 0 (see Figure 2-7).

Figure 2-7 SBB Shelf with 8-Bit I/O Module



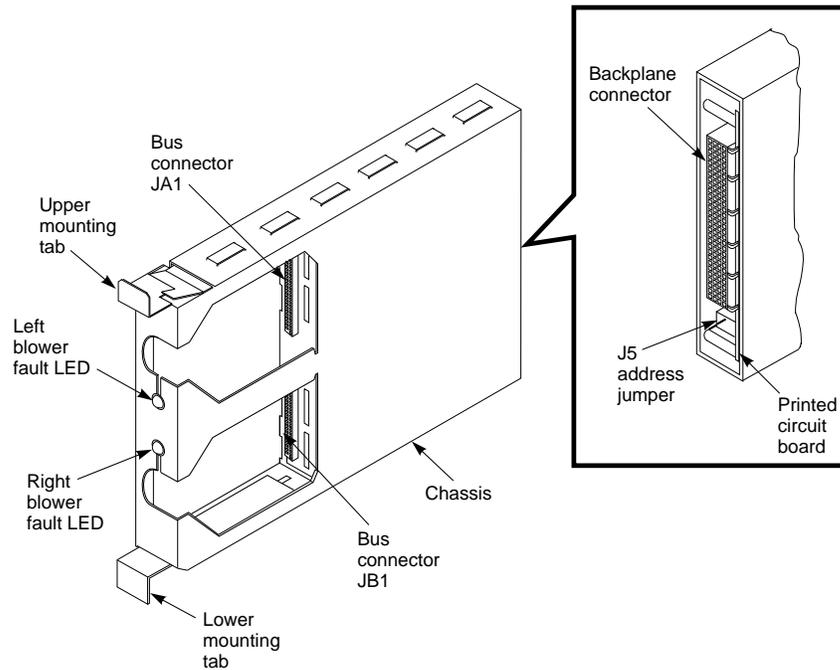
CXO-5411A-MC

On the front of the I/O module (see Figure 2-8) are two 50-pin female connectors: bus connector JA1, the data input connector, and bus connector JB1, the data output connector. In a split-bus configuration, both JA1 and JB1 are input connectors.

Guides embossed on the top and bottom of the I/O module prevent inserting the I/O module upside down and keep the module centered in the shelf slot. Two spring-steel mounting tabs lock into ledges molded into the top and bottom of the shelf secure the I/O module. Squeeze the mounting tabs together to pull the I/O module out of the shelf.

The upper LED indicates that the left blower motor has failed. The lower LED indicates that the right blower motor has failed. Fans at the rear of the shelf draw air from the front to cool the I/O module.

Figure 2-8 I/O Module Features



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2.4.1 Data Bus Connections

The I/O module provides an external connection for the SBB shelf buses. The backplane connector on the rear of the I/O module (see Figure 2-8) routes the bus and control signals from the shelf backplane to the I/O module circuits. These circuits connect the lower eight bits (0 through 7) of bus A to external bus connector JA1 and the lower eight bits of bus B to external bus connector JB1.

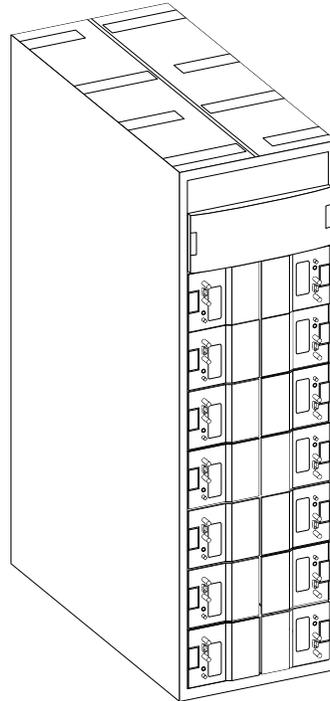
2.4.2 Bus Termination

The I/O module provides both active and passive bus termination for the two 8-bit shelf buses. The upper eight bits (8 through 15) of each bus are passively terminated by termination resistors. These data lines do not pass to the external bus connectors (JA1 and JB1). The lower eight bits (0 through 7) of SCSI bus B are actively terminated. These data lines are terminated as long as there is no connection to JB1. When JB1 is connected, the active terminators are disabled and these data lines pass through JB1.

2.5 SBB ECB Shelf

The external cache battery (ECB) is mounted in an SBB shelf without a backplane. The shelf is a repository for ECBs only (see Figure 2-9) and will be connected to the array controller's cache module (see Figure 2-10.)

Figure 2-9 SBB ECB Shelf



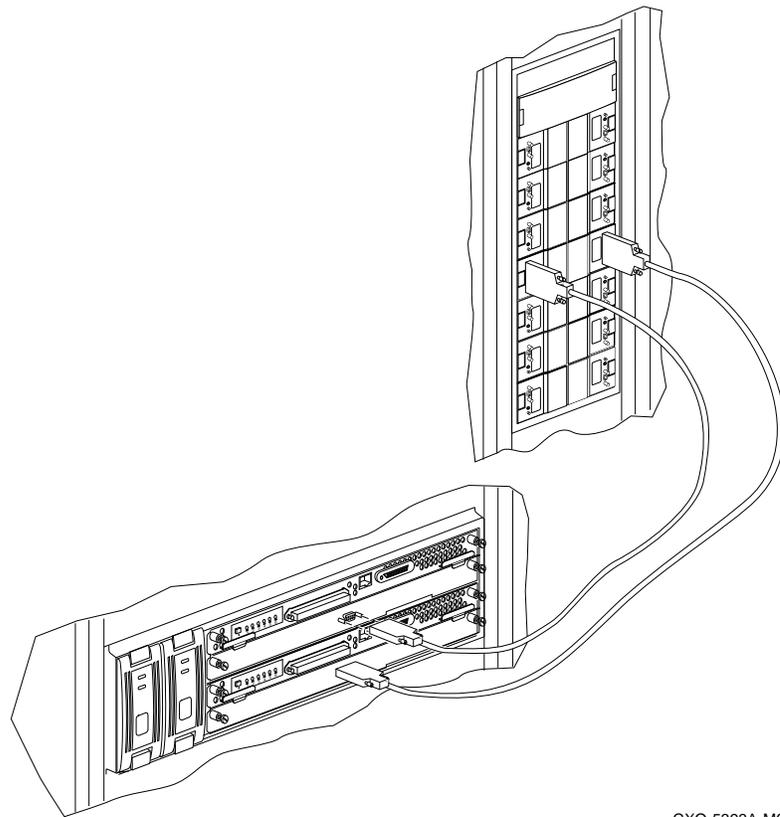
CXO-5408A-MC

The cache is mounted under the controller and is identified by the single plug in the middle of the module (see Figure 2-10). Note that the controller must be pulled out before the cache module can be removed.

Note

Cache module to ECB cables are factory installed. To remove and replace any controller, cache, or ECB part, refer to *Servicing Your StorageWorks Subsystem* documentation.

Figure 2-10 Cache to ECB Connection



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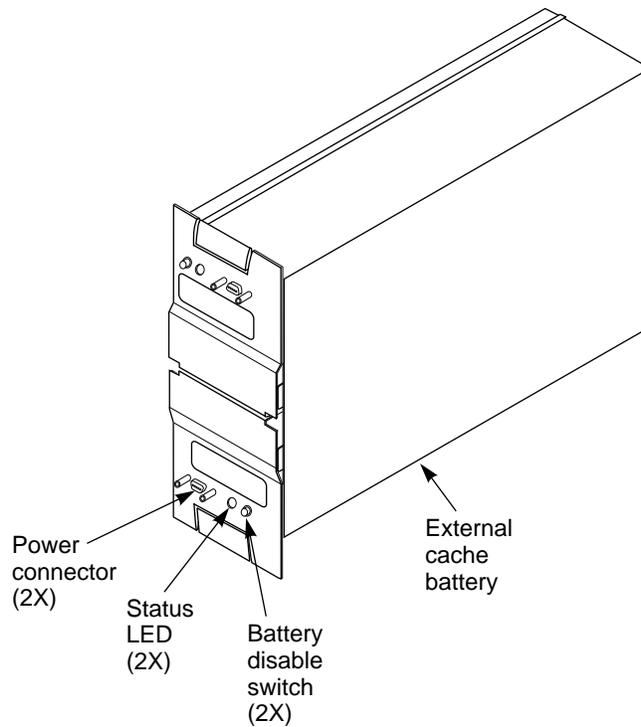
Each ECB supports two cache modules. To check the ECB status, look at the ECB status indicator LED (one for each cache module) for the appropriate indication (see Table 2-3 and Figure 2-11).

Table 2-3 ECB Status Indications

| LED status | Battery status |
|---|---|
|  | System power is on, and the ECB is fully charged. |
|  | System power is on, and the ECB is charging. |
|  | System power is off, and the ECB is supplying power to the cache. |
|  | System power is off, and the ECB is not supplying power to the cache. |

| | | | |
|--|---|---|--|
| Legend:  = On |  = Off |  = Blink fast |  = Blink slow |
|--|---|---|--|

Figure 2-11 ECB SBB



CXO-5267A-MC

Installing the Array Controller and Software

This chapter describes how to install the array controller SCSI cables and the array controller software.

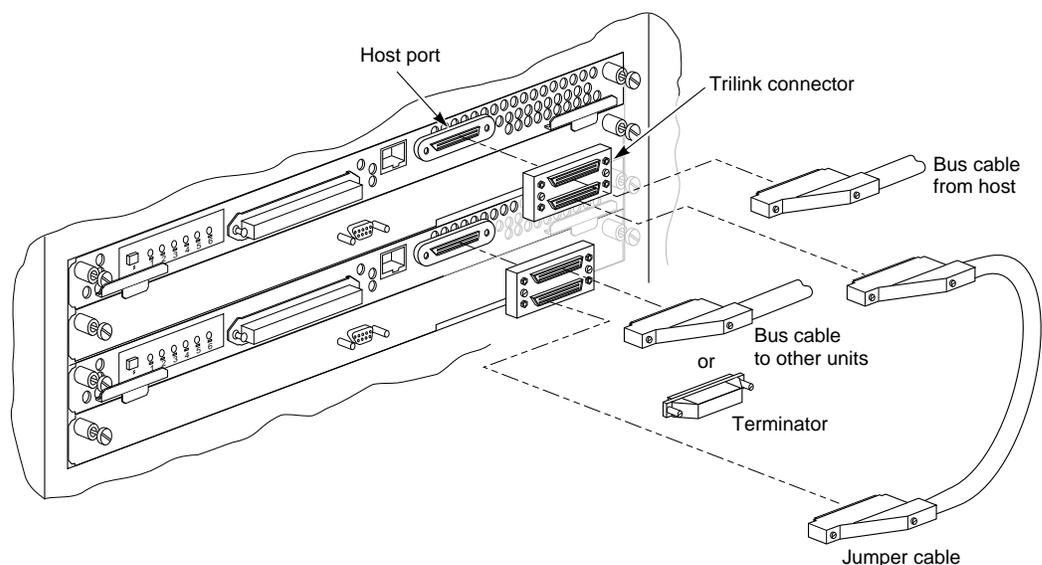
3.1 Controller Mounting

Controller shelves are mounted horizontally (see Figure 3-1) and vertically (see Figure 3-2). The primary controller is mounted in the bottom shelf slot (SCSI ID 7) and the redundant controller is mounted in the top shelf slot (SCSI ID 6).

The trilink connector attaches to the controller host port and the Bus cable from the host attaches to the trilink connector. The jumper cable and terminator are factory installed for ESA

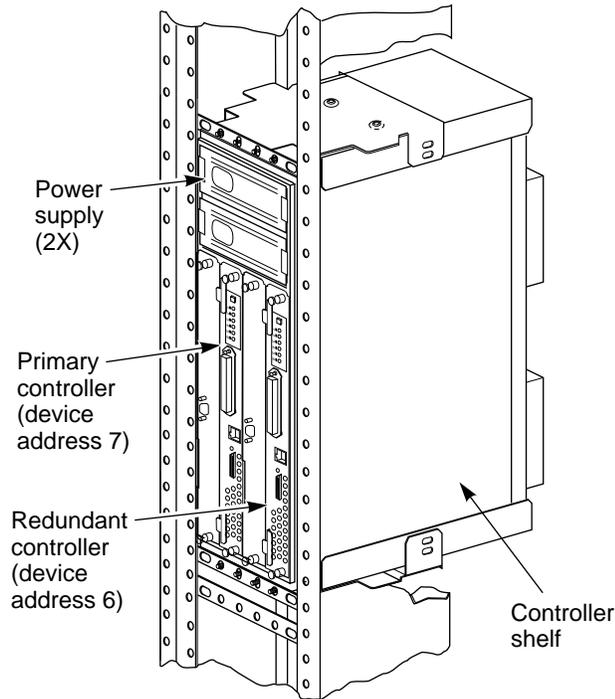
(see Figure 3-1).

Figure 3-1 Horizontal Mounted Controllers with Cache and Trilink Connectors



CXO-5301A-MC

Figure 3-2 Vertical Mounted Controllers with Cache



CXO-5395A-MC

3.2 Host-to-Controller Cable Routing

The cabinet uses HSZ-series controllers that use the SCSI interface as the communication path with the host computer and for the storage device bus. Use the following cabling guidelines to route the SCSI cables to each controller:

- All SCSI host interface cables enter the cabinet through openings at the bottom rear of the cabinet (same entry point as the power cables).
- If the controllers are located at the rear of the cabinet, route the cables directly to each controller trilink connector.
- If the controllers are located in the front of the cabinet, route the cables to the front through the openings beside the CDUs.
- After the cables are routed through the cabinet, attach the host SCSI cable to the trilink connector on the front of the controller.
- If you have not installed the host SCSI adapter in your host system, do so now. Refer to your host adapter installation guide for detailed information on connecting the host SCSI bus cable to the host adapter.

3.3 Installing the Operating Software

The program card contains the array controller operating software (HSOF). Refer to Figure 3-3 during this installation procedure.

Note

Insert the program cards prior to applying power to your cabinet. Be aware that the program cards may have been installed at the factory.

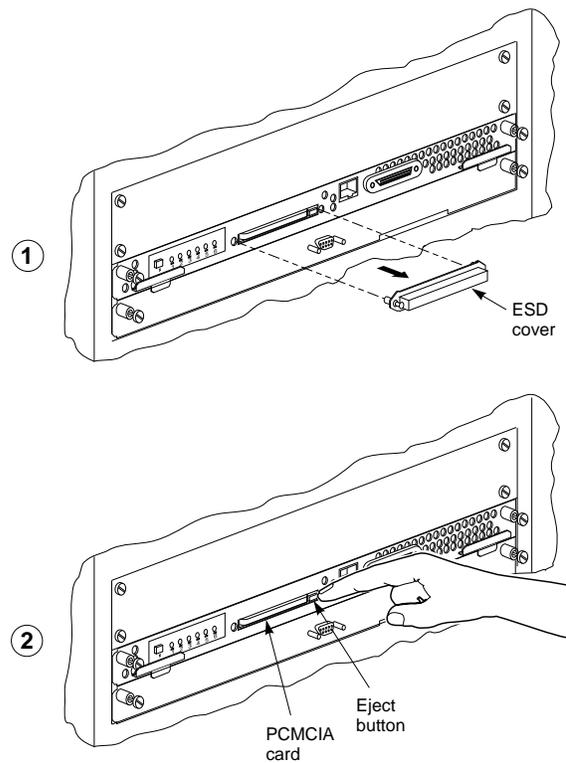
Proceed as follows to install the program card:

1. Attach an ESD grounding strap to your wrist at one end and the cabinet grounding stud at the other.
2. Remove the program card ESD cover.
3. Insert the program card into the program card slot on the controller's front bezel, until the eject button is even with the edge of the card.
4. Snap the program card ESD cover in place over the program card.
5. Remove the ESD grounding strap.

CAUTION

The program card *must* remain inserted at all times during controller operation with ESD cover in place. If the program card is removed during operation, the controller *will not* function and the reset button must be used.

Figure 3-3 Installing the Program Card



Applying Cabinet Power

This chapter describes how to apply power to your ESA cabinet and also provides a general description of the dual CDU power configuration and storage set cabling.

WARNING

Electric Shock Hazard! Before working inside the cabinet, remove power from the cabinet and its components. Failure to do so may result in death or personnel injury.

Proceed as follows to apply power to the cabinet:

1. Open the front and rear cabinet doors.
2. Switch CDU A and CDU B front panel circuit breakers to the | (ON) position.
3. Check to make sure the controllers have initialized. If the controller initializes correctly, the green reset LED will begin to flash one time per second.

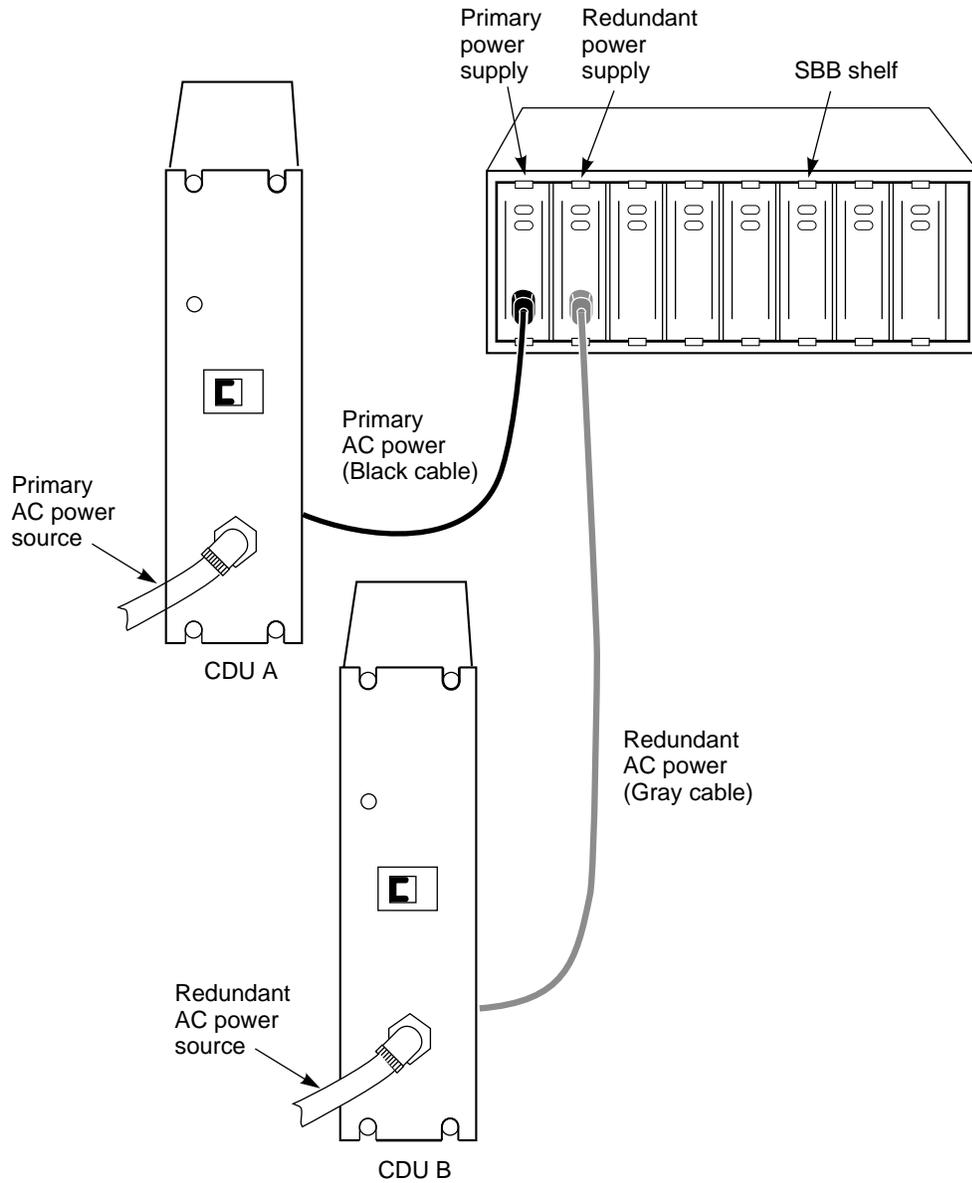
Note

If an error occurs during initialization, the OCP will display an error code. Refer to *Servicing Your StorageWorks Subsystem* to interpret the LED codes.

4.1 Redundant Power Configuration

All ESA systems use the redundant CDU power configuration (see Figure 4-1): CDU A is connected to the primary power source and CDU B is connected to the redundant power source. CDU A provides power to the primary ac power supply in each shelf and CDU B provides power to the redundant ac power supply in each shelf. If the primary power source CDU A or ac power supply A fails, the shelf remains powered by CDU B, or ac power supply B. This configuration provides complete power redundancy to the shelf peripheral devices.

Figure 4-1 Dual CDU Power Configuration



CXO-5396A-MC

4.2 Storage Set Cabling

The cabinet is cabled at the factory. This section is used for reference to describe how the storage sets (a combination of SBB and controller shelves that make up set amount of storage) were configured and how the controller shelves are connected to SBB shelves I/O modules. It shows the location of the controller shelf, SBB shelves, and cable routing of each storage set. See the appropriate user's guide for detailed information about the cabinet, the shelves, or the I/O modules.

The cabinet has five split bus configuration storage sets. Each storage set consists of one controller shelf with a redundant controller and three SBB shelves with an 8-bit I/O module in each. All shelves have a redundant power supply. Figure 4-2 shows an SBB shelf with I/O module, power supplies, and SBBs. Figure 4-3 shows a controller shelf with I/O cable connectors.

Figure 4-2 SBB Shelf with 8-Bit I/O Module

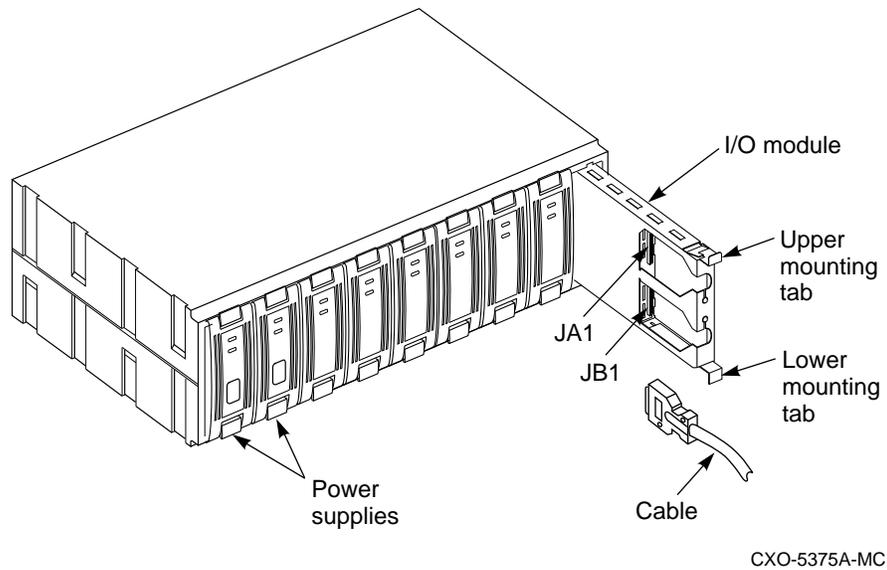
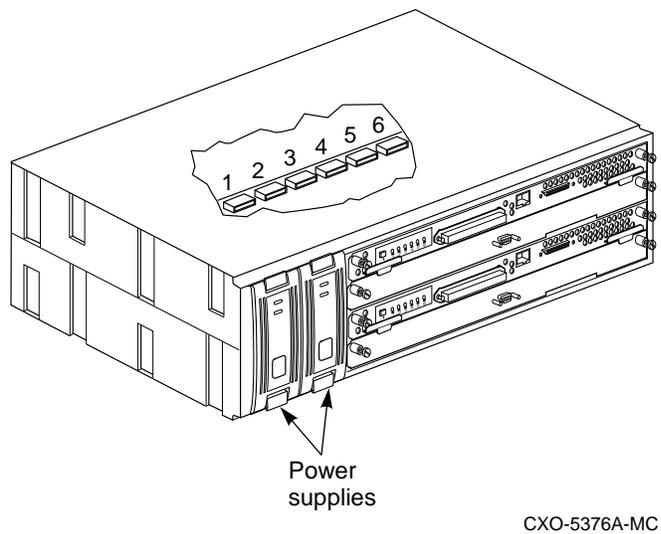


Figure 4-3 Controller Shelf with I/O Connectors



The five cabinet storage sets and their cable connections are shown in Figure 4-4 through Figure 4-10 (each shaded area is a storage set). Refer to Table 4-1 for the number of storage sets that combine for the total storage capacity.

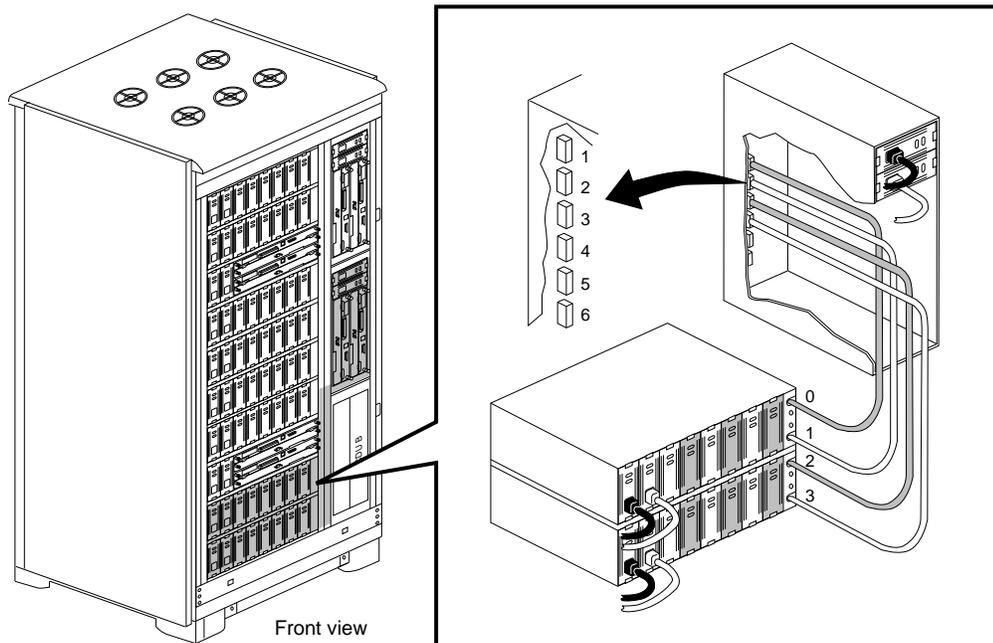
Note

The shaded areas in the detailed section of each illustration indicates the SBBs that belong to each bus in the split bus configuration. Bus 1 includes 1, 3, and 5; and Bus 2 includes SBBs 2, 4, and 6.

Table 4-1 Storage Sets

| If the storage capacity is ... | See storage sets ... |
|--------------------------------|--------------------------------------|
| 150 Gigabytes | 1, 2, 3 |
| 350 Gigabytes | 1, 2, 3, 4, 5, 6, 7 (1 full cabinet) |
| 700 Gigabytes | 2 full cabinets |
| 1050 Gigabytes | 3 full cabinets |

Figure 4-4 Storage Set 1



CXO-5385A-MC

Figure 4-5 Storage Set 2

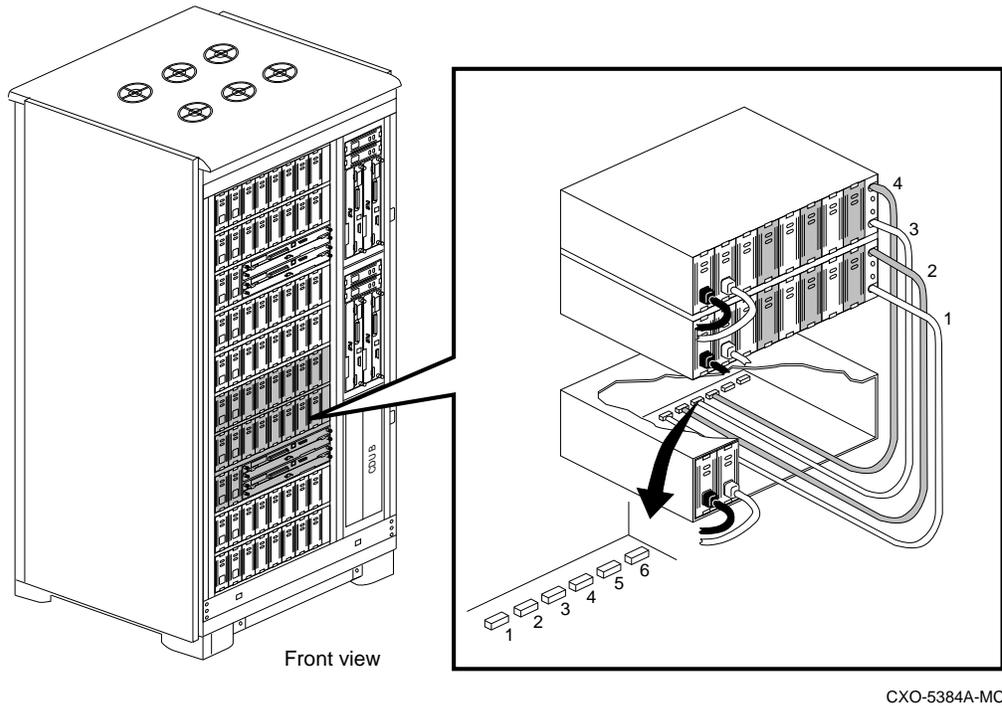


Figure 4-6 Storage Set 3

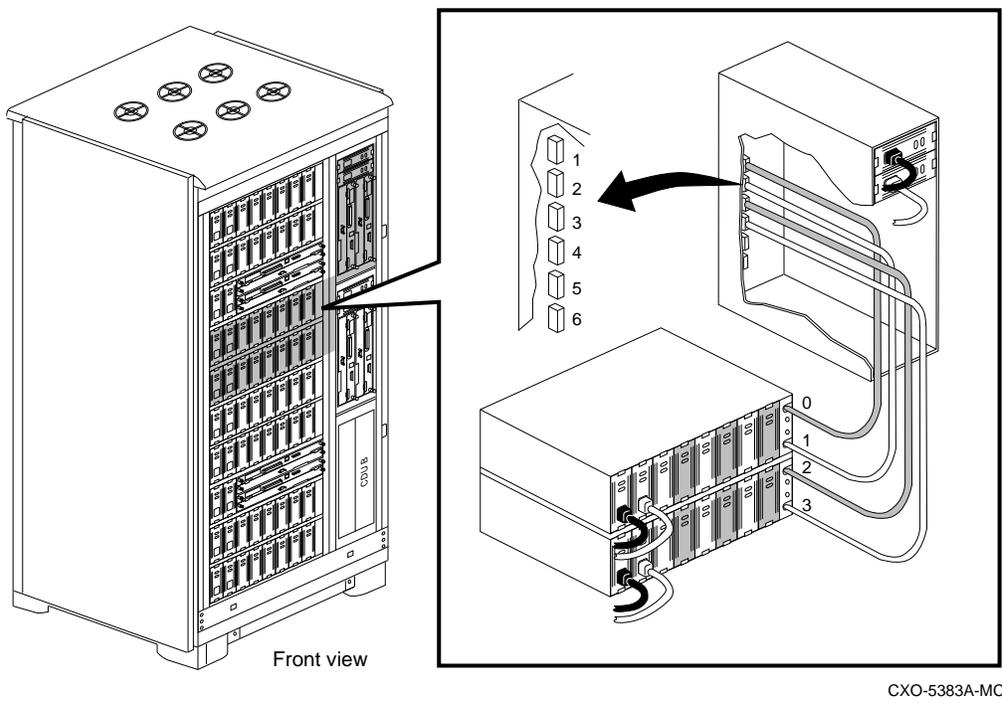


Figure 4-7 Storage Set 4

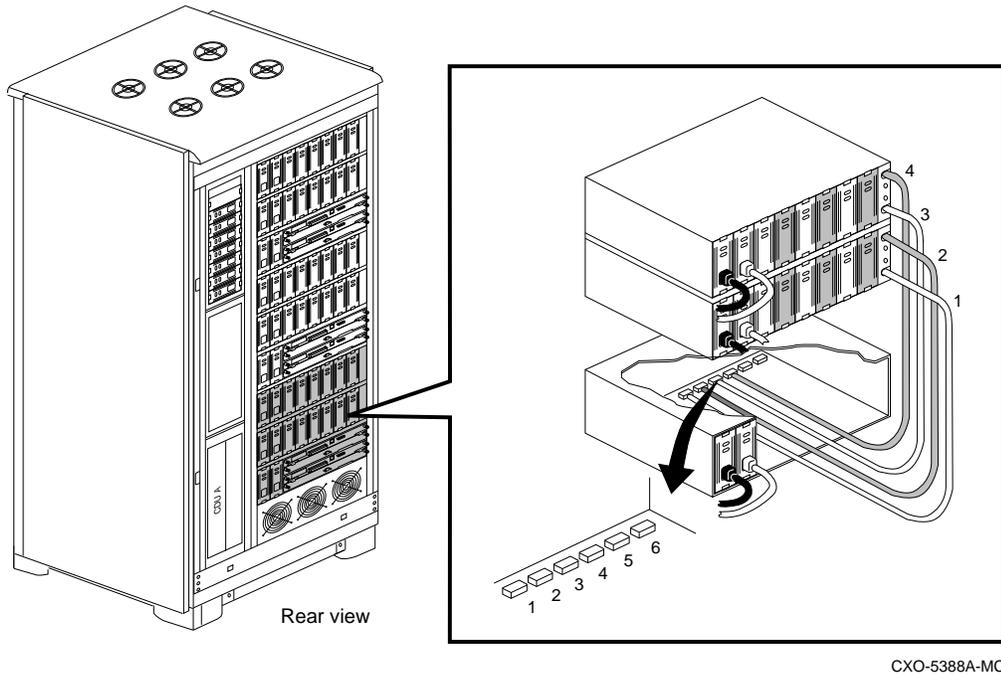


Figure 4-8 Storage Set 5

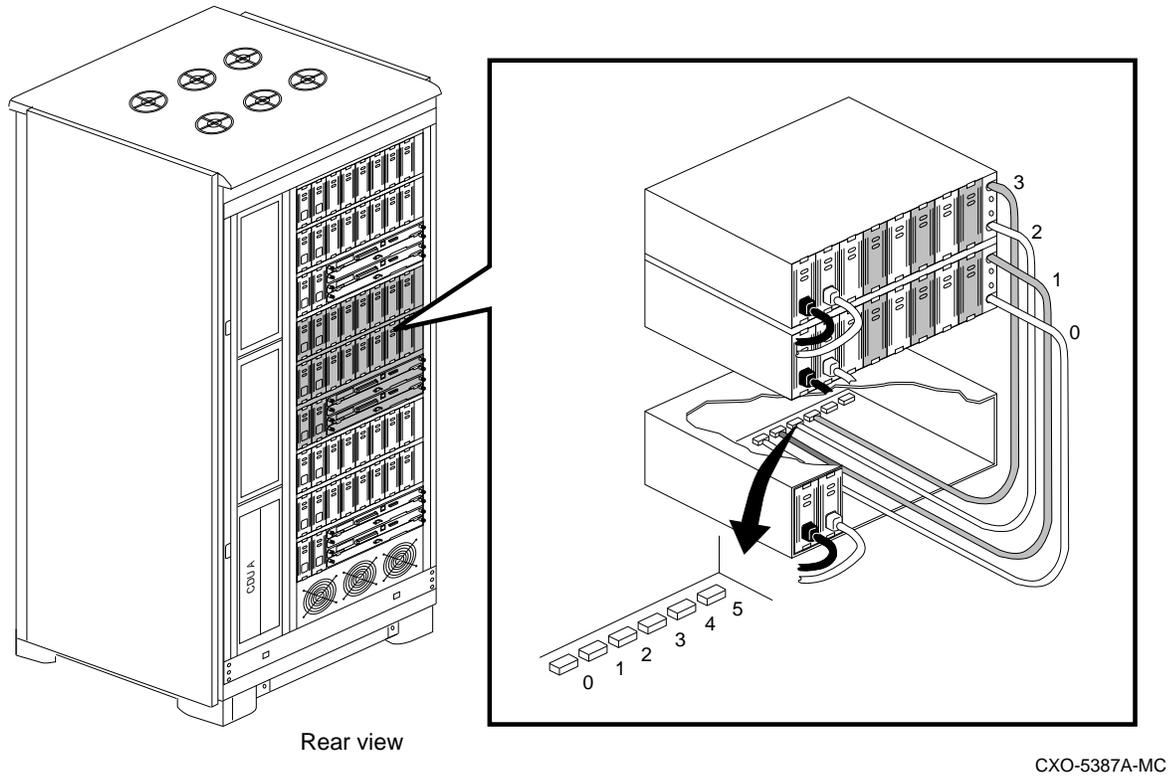
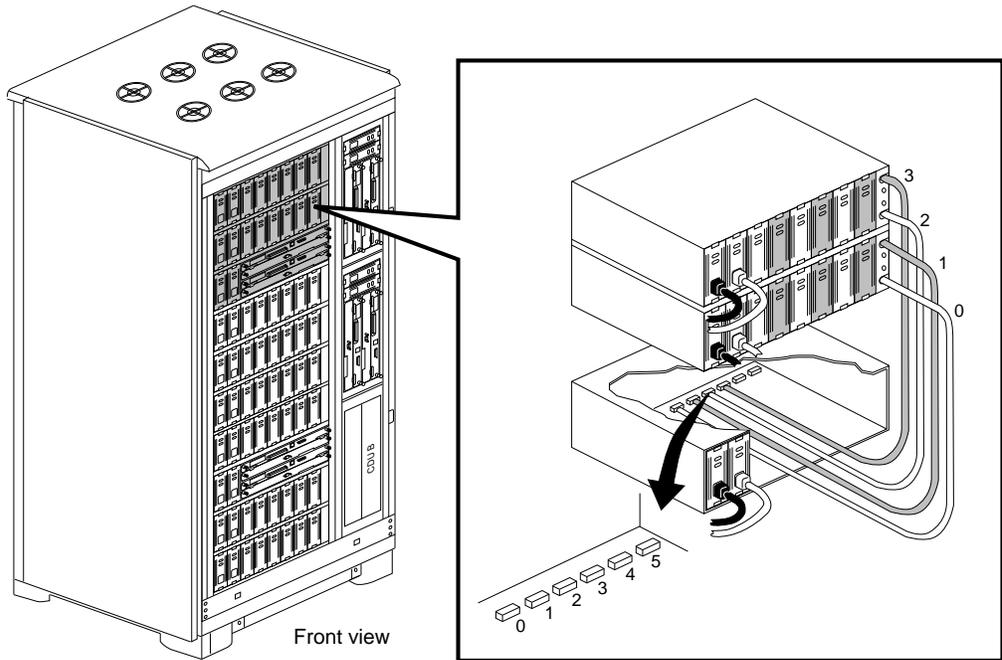
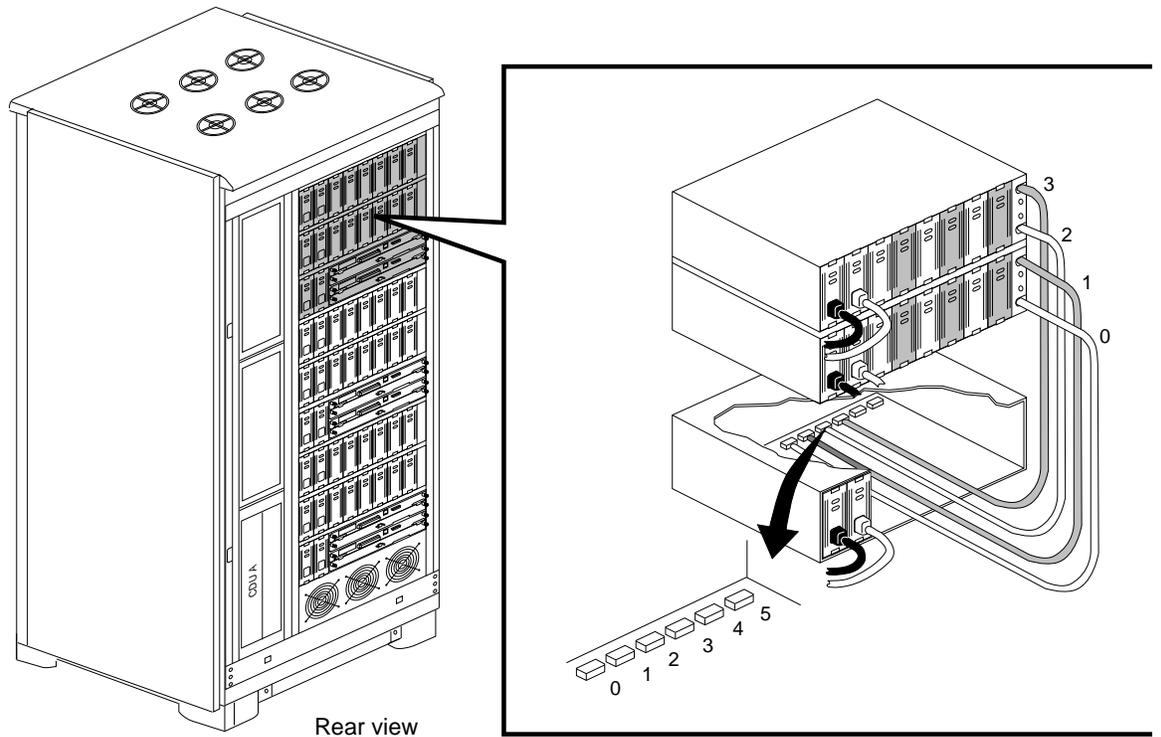


Figure 4-9 Storage Set 6



CXO-5382A-MC

Figure 4-10 Storage Set 7



CXO-5386A-M

Installing the StorageWorks Command Console

This chapter describes how to install the StorageWorks Command Console (SWCC) program modules on your personal computer and host system.

The SWCC is a feature-rich, graphical user interface (GUI) and remote management program for StorageWorks controllers. It provides an extremely user-friendly method of monitoring, configuring, and troubleshooting your ESA.

5.1 Client System Requirements

Table 5-1 outlines the *minimum* system configuration needed to run client.

Table 5-1 Minimum PC System Configuration Requirements

| Feature | Minimum Requirements |
|--|--|
| PC CPU Speed Memory | Intel 486 66 MHz 16 MB |
| Free Disk Space | 10 MB |
| Operating System | Windows NT 3.51 (Build 1057 or later) or Windows 95 (Build 950 or later) |
| Display Size Type Resolution | 15" VGA 800 x 600 |
| Input Devices | CD-ROM Keyboard Mouse |
| Modem | Hayes compatible |
| Network Adapter | TCP/IP Compatible |

SWCC connects to StorageWorks HSZ-series controllers. The TCP/IP connection must be in operation before the program begins to issue commands and interpret the responses sent by the controller. The user interface displays in graphical form, the logical and physical layout and status of a selected subsystem.

The SWCC has the following major features:

- High and low-level status monitoring of the storage subsystem using colored icons
- Graphical view of the controller and its physical and logical storage elements
- Host port SCSI bus virtual terminal connection to the storage array

- Automatic event logging in Windows NT® Version 3.51
- Graphical configuration of the storage array
- Network connection via TCP/IP protocol
- User and feature access protection
- Remote fault notification by pager

5.2 Program Modules

The SWCC consists of two program modules:

- SWCC client is the GUI portion of SWCC. The client is a 32-bit application designed to run on Microsoft Windows NT® Version 3.51 and Windows 95® systems.
- SWCC agent is a host agent program that works with the client for network connectivity. For detailed information, refer to the applicable agent user's guide (all SWCC documentation, except *Getting Started with Command Console* are located on the SWCC CD-ROM).

The SWCC modules are referred to as the *client* and the *agent*. The term *SWCC* refers to both client and agent working together.

5.3 RAID Support and Terminology

The SWCC supports the following RAID configurations:

- RAID 0—RAID 0 is the industry standard for striping. A single logical disk spans multiple physical disks. This is the only RAID level that does not provide redundancy. The client uses the term *stripeset* for a RAID 0 volume available to the host.
- RAID 1—A single logical disk replicated on two or more physical disks. The mirroring technique provides data redundancy. The client uses the term *mirrorset* for a RAID 1 volume available to the host.
- RAID 0+1—Combines the striping of RAID 0 and the shadowing/mirroring of RAID 1, to provide the best combination of very good performance and high availability. The client uses the term *striped mirrorset* for a RAID 0+1 volume available to the host.
- RAID 3/5—Stripes and distributes parity chunks across all members in the array. RAID 3/5 is the best choice for most applications with small to medium input/output requests *unless* the application is write-intensive. The client uses the term *RAIDset* for a RAID 3/5 volume available to the host.

5.4 Installing the SWCC

The following steps, extracted from *Getting Started with Command Console*, are required to install the StorageWorks Command Console and are **shown here for reference only**:

1. Install the Adobe Acrobat Reader so that you can view the documentation on the accompanying CD-ROM.
2. Access the documentation on the accompanying CD-ROM.
3. Read the release notes on the CD-ROM.
4. Choose either a local or network connection for the client.
5. Install the client software on your local system.
6. If you choose the network connection method, install the agent software in your hosts.

Note

During agent installation be aware of the following:

1. The manufacturer of all agents is DIGITAL.
2. The array controllers for ESA were preconfigured at the factory with one LUN (a requirement for the SWCC or it cannot “see” the controller). The LUN is D200. You will need this information when installing the agent.
3. After agent installation is complete the REMOTE PLATFORM INSTALL UTILITY window appears. Select CANCEL to close the window (the install *will not* be canceled).
4. When the AGENT SETUP UTILITY window appears, select CANCEL. Your installation is complete.

Note

The following sections are provided as an overview and are to be used for reference only. Refer to the applicable system manuals as required.

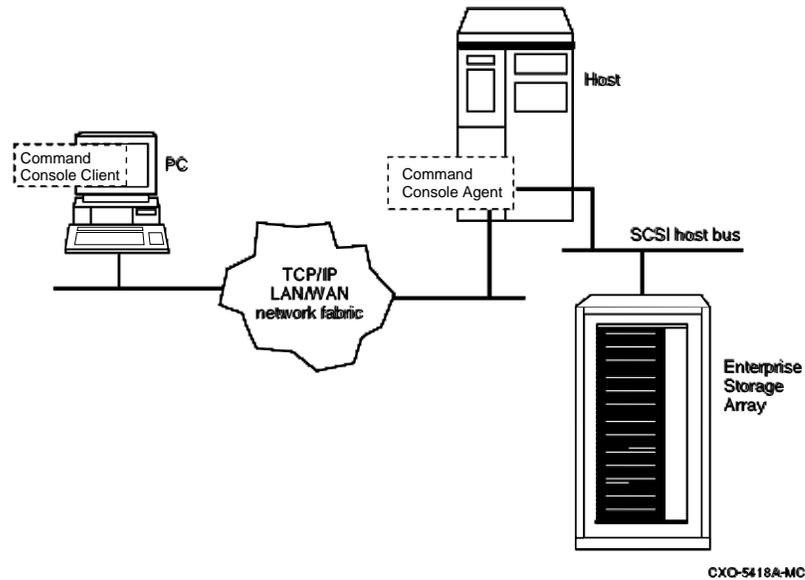
5.5 Network Connection

The SWCC has sophisticated networking capabilities. If the personal computer you are using to operate the client has a TCP/IP network connection, you may connect the program to your storage subsystem via the network. To connect this way, you must operate the agent program in your host.

The agent acts as the client's assistant in controlling your storage subsystem. Commands sent from the client are received by the agent and are routed to the storage subsystem via the subsystem's SCSI host bus. Subsystem status is transmitted back to the client from the agent via the network connection. The agent also can be used for access protection.

You must operate the client as a network version to make this connection (see Figure 5-1).

Figure 5-1 Network Connection Using Agent

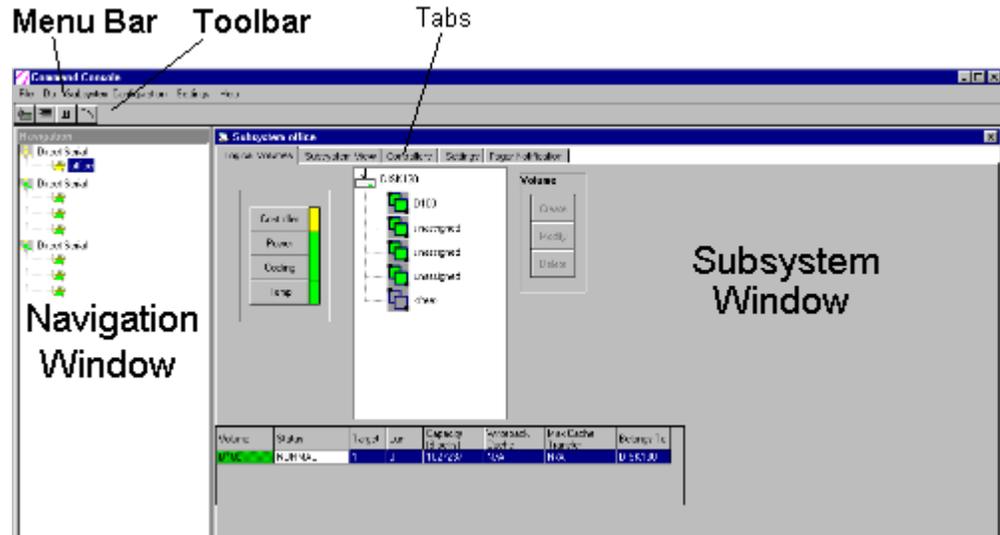


You can run up to 32 concurrent client stations at a time. You can connect concurrently to up to 128 host systems, each with up to 32 storage subsystems for a maximum of up to 4096 concurrent subsystem connections.

Using a network connection, you can configure and monitor your storage subsystem from anywhere on your LAN. If your LAN has WAN or Internet connectivity, you can monitor your subsystem with TCP/IP network reliability from anywhere in the world.

5.6 SWCC Client Interface

This section describes the operating modes, subsystem views, and menu structure of the client. The control panel is client's workspace. It is divided into four window areas as shown:



- The Menu Bar is at the top of the Control Panel and provides menu selections for all of the client functions.
- The Toolbar is directly under the Menu Bar and provides buttons to activate some of the more often-used client functions.
- The Navigation Window is on the left-hand side of the Control Panel and under the Toolbar. It enables you to quickly connect to the subsystems for which you have configured the client.
 - Host systems and storage subsystems are represented by icons in a *tree* structure. You can double-click on any host system icon to show the subsystems attached to it. To select a storage subsystem to connect to, click on the subsystem icon.
- The Subsystem Window is to the right of the Navigation Window and provides the bulk of the information on the system you are currently viewing. One system can be viewed in the window at a time. One system can be viewed in the window at a time. Click the View Subsystem button on the Toolbar to open the Subsystem Window and display detailed information on the selected subsystem.
 - The Subsystem Window provides a number of information tabs to display specific information on the subsystem connected to. Click on a tab to select it and to refresh the window. Colored icons show the status of storage elements in the subsystem.

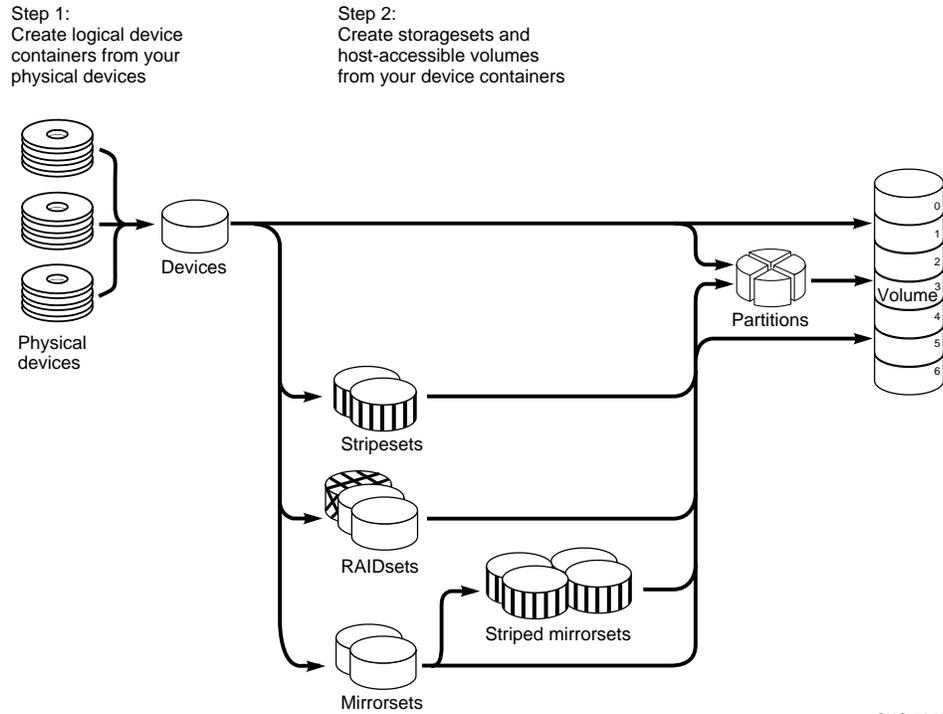
5.6.1 Basic Operation

To view information on a specific storage subsystem, simply click on the subsystem in the Navigation Window to select it. Then click the View Subsystem button on the Toolbar. The client connects with the subsystem and refreshes the Subsystem Window with detailed configuration information. Select a tab in the Subsystem Window to view and configure specific information.

In the HSZ50 controller, the configuration process involves multiple steps, each consisting of one or more CLI commands used to build not only volumes, but interim containers. Subsystem configuration in client is a simple, two-step process, as shown in Figure 5-2. Note

that in the client, you create the volume at the same time that you create the container it is based on.

Figure 5-2 The Configuration Process in the Client



5.6.2 Subsystem Window

The Subsystem Window offers you a number of tabbed views of information on the subsystem chosen in the Navigation Window. The following sections describe each of the tabs:

- Logical Volumes
- Subsystem View
- Controllers
- Settings
- Pager Notification

5.6.3 Logical Volumes Tab

The Logical Volumes tab shows the containers and volumes configured in the selected subsystem. Each container is shown as an icon displaying its configuration. By clicking on the icon for a particular container, you can expand the display and view the volumes based on it. An example of the Logical Volumes tab is shown:

The screenshot displays the 'Logical Volumes' tab for a subsystem named 'system7'. The interface includes a navigation bar with tabs for 'Logical Volumes', 'Subsystem View', 'Controllers', 'Settings', and 'Pager Notification'. On the left, there is a panel for monitoring 'Controller', 'Power', 'Cooling', and 'Temp', each with a green indicator bar. The main area shows a hierarchical tree of disks and volumes. DISK100 is expanded to show volume D600. DISK110 shows volumes D500 and <free>. DISK120 shows volumes D501 and <free>. DISK130 shows volume D502. On the right, a 'Volume' panel contains 'Create', 'Modify', and 'Delete' buttons. At the bottom, a table provides detailed information for each volume.

| Volume | Status | Target | Lun | Capacity (Blocks) | Writeback Cache | Max Cache Transfer | Belongs To |
|--------|--------|--------|-----|-------------------|-----------------|--------------------|------------|
| D600 | NORMAL | 6 | 0 | 8811712 | OFF | 32 | DISK100 |
| D500 | NORMAL | 5 | 0 | 1027237 | ON | 1024 | DISK110 |
| D501 | NORMAL | 5 | 1 | 2054480 | ON | 1024 | DISK120 |
| D502 | NORMAL | 5 | 2 | 2096259 | ON | 1024 | DISK130 |

5.6.4 Subsystem View Tab

The Subsystem View tab shows the physical devices in the selected subsystem. Each device is shown as an icon that indicates the type of container of which it is a member. By clicking on the icon for a particular volume, you can view its attributes. The seven device pedestal (configuration setting 2) Subsystem View tab is shown. ESA uses the generic view setting (not shown).

| Container Name | Type | Status | Target | Lun | Capacity (Blocks) | Chunksize (Blocks) |
|----------------|-----------|--------|--------|-----|-------------------|--------------------|
| SPARESET | spareset | | N/A | N/A | N/A | N/A |
| FAILEDSET | failedset | | N/A | N/A | N/A | N/A |
| DISK100 | jbod | NORMAL | 6 | 0 | 8811712 | N/A |
| DISK110 | jbod | NORMAL | N/A | N/A | 4108970 | N/A |

5.6.5 Controllers Tab

The Controllers tab shows the controller operating parameters in the selected subsystem. You can reconfigure the parameters by selecting options in the tab. An example of the Controller tab is shown:

The screenshot shows the 'Controllers' tab for subsystem 'system5'. The interface includes a title bar 'Subsystem system5' and a tabbed menu with 'Logical Volumes', 'Subsystem View', 'Controllers', 'Settings', and 'Pager Notification'. The 'Controllers' tab is active. It features a 'Common Parameters' section with three sub-sections: 'SCSI ID's' (four input boxes containing 1, 2, 3, 4), 'Cache Policy' (radio buttons for A and B, with B selected), and 'Host Functionality' (radio buttons for A, B, C, and D, with B selected). To the right are 'Restart Both' and 'Cancel' buttons. Below this are two main sections: 'This Controller' and 'Other Controller'. 'This Controller' has 'Preferred ID's' (checkboxes for 1, 2, 3, 4, all checked), 'This Cache Flush Timer' (input box with 10), and a 'Restart This' button. 'Other Controller' has 'Preferred ID's' (checkboxes for 1, 2, 3, 4, all unchecked), 'Other Cache Flush Timer' (input box with 10), and a 'Restart Other' button.

5.6.6 Settings Tab

The Settings tab shows the basic display information for the selected subsystem. You can reconfigure the parameters by selecting options in the tab. An example of the Settings tab is shown:

The screenshot shows the 'Settings' tab for subsystem 'demo_sys'. The interface includes a title bar 'Subsystem demo_sys' and a tabbed menu with 'Logical Volumes', 'Subsystem View', 'Controllers', 'Settings', and 'Pager Notification'. The 'Settings' tab is active. It features a 'Subsystem View' dropdown menu showing '7-device Pedestal (Config setting 2)'. To the right is a 'Host Agent System Name' input box containing 'system7'. Below these are a 'Numeric Subsystem ID' input box containing '1' and a 'Storage Subsystem Name' input box containing 'subsystem7a'. At the bottom are 'OK' and 'Cancel' buttons.

5.6.7 Pager Notification Tab

You can configure client for remote fault notification via numeric telephone pager. Using the Pager Notification tab, you can set customized, numeric messages for various subsystem fault types. If it is configured for remote fault notification, the program automatically dials your pager and transmits the appropriate fault message when it senses a subsystem fault. Up to three different pagers can be configured over different time frames to cover various working shift requirements.

You can reconfigure the parameters by selecting options in the tab. An example of the Pager Notification tab is shown:

Subsystem system5

Logical Volumes | Subsystem View | Controllers | Settings | **Pager Notification**

Pager #1

Dial String:

Start Time: End Time:

Pager #2

Dial String:

Start Time: End Time:

Pager #3

Dial String:

Start Time: End Time:

| Failure | Message to Send | Notify #1 | Notify #2 | Notify #3 |
|--------------------------|----------------------|--------------------------|--------------------------|--------------------------|
| Disk Failure | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Power Failure | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Fan Failure | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Cache Battery Low | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Temperature Problem | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| THIS Controller Problem | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Communication Loss | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| OTHER Controller Problem | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Use Defaults
Customize
Save

5.7 Utility Functions

The client provides a number of utility functions to enhance the usability and maintenance of your storage subsystems.

5.7.1 Controller Firmware Download

Client enables you to upgrade controller firmware by downloading it via the local host SCSI port. The **Configuration|Controller Firmware Load** menu option enables you to specify the firmware file to be downloaded. The client automatically performs the download operation once the file has been selected.

5.7.2 Saving and Viewing a Configuration File

You can save a representation of the current subsystem by using the **File|Save** menu option. The subsystem configuration is saved in an ASCII text file. You can name the file to save any number of subsystem configurations for later use.

You can view the contents of a previously saved configuration file by selecting the **System View|Configuration File** menu option.

5.7.3 Configuring from a Configuration File

You can use a previously saved configuration file to configure the subsystem via the **Configuration|Configure From File** menu option.

5.7.4 Password Protection

Enterprise Storage Manager offers three levels of user subsystem access:

- High-level monitoring access—*Good/Bad* indication at the host connection and storage subsystem levels. Notification of subsystem faults as they occur. No access to detailed information on storage subsystem status or configuration.
- Low-level monitoring access—High-level monitoring capabilities, along with access to detailed information about the status and configuration of the storage subsystem. In addition to *Good/Bad* status, the user can view the detailed operating parameters of all controllers, devices, and volumes.
- Configuration access—High and low-level monitoring capabilities, along with the capability of changing the configuration of the storage subsystem. Configuration features include: adding and deleting devices, creating and deleting volumes, modifying volume options, configuring using a configuration file, saving a configuration file, and installing new controller firmware.

The type of connection you are using determines the access protection options available to you.

5.7.4.1 Protection for Local Connections

If you are using Client with a local serial port or host SCSI bus connection, all users have high-level monitoring access and low-level monitoring access. You can restrict user configuration access using local password protection. When the local password is set, any activities involving changes to the configuration of the storage subsystem are restricted. Note that the local password provides access protection only for local connections to the storage subsystem.

5.7.4.2 Protection for Network Connections

If you are using the client with an agent over a network, you have more control over access to your storage subsystems than with local connections. Any number of client sessions, each running on a network-capable system, can monitor thousands of storage subsystems over the network. The clients and the agents work together, using passwords and the IP addresses of the host and the client systems, to provide access protection to each, individual, client session. With network connections, all users have high-level monitoring access to each storage subsystem. By configuring Agent, you can control access at these, two levels:

- Low-level monitoring access
- Configuration access

Enterprise Storage Manager's protection options are set up at the agent end of the communication link. Once you set up a host session of an agent with the IP addresses, passwords, and authorized access for each client session that is to access it, your storage subsystem is secure.

When you open a client on a system with an IP address that's authorized for the storage subsystem you are trying to access, the program prompts you for a password. Client passes your encrypted password to the agent. The agent compares the client's system IP address and the password with the those for the specific storage subsystem in its configuration files. The agent then allows access to the client session at the level specified in its files.

5.7.5 Controller Communication

In the local version of the client, you can configure the communications interface with the controller via the **Settings|Controller Communications** menu option. The interface can be set up for either direct or modem connections, for a host port SCSI virtual terminal connection.

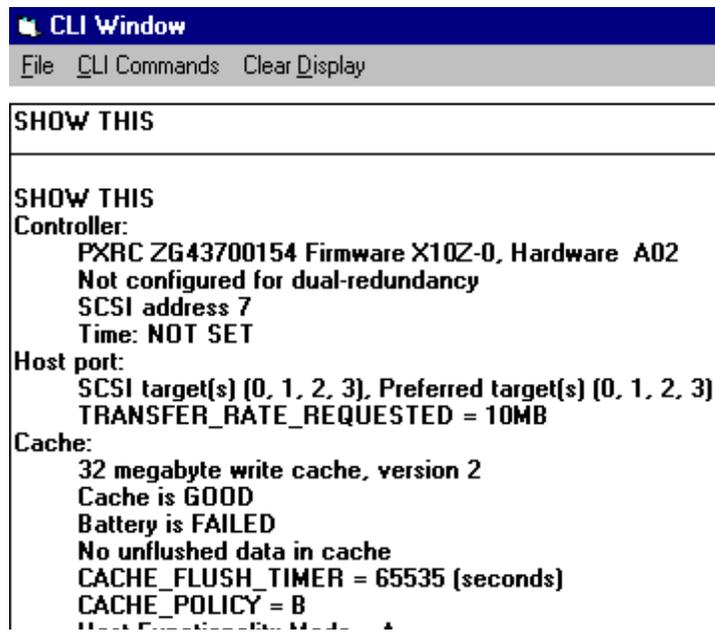
5.7.6 Command Line Interpreter Utility

The command line interpreter (CLI) is a text-based interface for monitoring and configuring your storage subsystem. The client provides you with a text-based window for this controller interface, accessed from the **System View|CLI Window** menu. Refer your controller documentation for details on the CLI.

Because the configuration of the storage subsystem can be changed using CLI commands, consider only allowing CLI access only for users who are already familiar with the CLI operations. Access to the CLI utility can be limited through the use of a password, as described in Section 5.7.4.

The CLI utility window presents you with a command-entry area and a larger response area below it. You can enter commands in the command-entry area, and the controller's responses are displayed in the response area.

An example of the CLI utility screen is shown:



```
CLI Window
File CLI Commands Clear Display

SHOW THIS

SHOW THIS
Controller:
  PXRC ZG43700154 Firmware X10Z-0, Hardware A02
  Not configured for dual-redundancy
  SCSI address 7
  Time: NOT SET
Host port:
  SCSI target(s) [0, 1, 2, 3], Preferred target(s) [0, 1, 2, 3]
  TRANSFER_RATE_REQUESTED = 10MB
Cache:
  32 megabyte write cache, version 2
  Cache is GOOD
  Battery is FAILED
  No unflushed data in cache
  CACHE_FLUSH_TIMER = 65535 (seconds)
  CACHE_POLICY = B
```

Glossary

ac power supply

A power supply designed to produce dc power from an ac input.

American National Standards Institute

See ANSI.

ANSI

American National Standards Institute. An organization that develops and publishes electronic and mechanical standards.

blower

An airflow device mounted in a StorageWorks shelf.

cable distribution unit

See CDU.

carrier

A standard, StorageWorks shelf-compatible, plastic shell into which a device can be installed. Sometimes called SBB carrier.

CDU

Cable distribution unit. The power entry device for StorageWorks cabinets. The unit provides the connections necessary to distribute ac power to cabinet shelves and fans.

controller

A hardware/software device that facilitates communications between a host and one or more devices. A controller translates bus protocols and hardware interfaces and adds functionality to the host/device communications.

data center cabinet

A generic reference to the large cabinets, such as the cabinet in which StorageWorks enterprise storage array components are mounted.

ECB

An External Cache Battery. A device housed in a standard StorageWorks SBB carrier that mounts in a SBB shelf. It provides cache backup power to the controller cache module.

fan

An airflow device mounted in a StorageWorks cabinet.

filler panel

A sheet metal or plastic panel used to cover unused mounting areas in StorageWorks cabinets and shelves.

host

The primary or controlling computer to which a storage subsystem is attached.

redundant

A configuration in which there is backup hardware in place for the hardware that is present.

SBB

StorageWorks building block. A device housed in a standard StorageWorks SBB carrier. An SBB has a standard physical and electrical interface that is compatible with those of StorageWorks shelves and enclosures.

SBB shelf

StorageWorks building block shelf. A StorageWorks shelf, such as the BA350-Sx, designed to house plug-in SBB modules.

SCSI

Small Computer System Interface. An ANSI interface defining the physical and electrical parameters of a parallel I/O bus used to connect hosts to a maximum of seven devices. The StorageWorks device interface is implemented according to the SCSI-2 standard, allowing the synchronous transfer of 8-bit data at rates of up to 10 MB/s.

skirt

A trim panel designed to mount around the base of the cabinet.

Small Computer System Interface

See SCSI.

StorageWorks

Digital's family of modular data storage products that allows customers to design and configure their own storage subsystems. Components include power,

packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in

StorageWorks enclosures to form storage subsystems.

StorageWorks building block

See **SBB**.